International Journal of Infectious Diseases 14S (2010) e242–e245

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Case Report

Acute infection of a total knee arthroplasty caused by *Pasteurella multocida*: a case report and a comprehensive review of the literature in the last 10 years

John Heydemann [a], Jacob S. Heydemann [b], Suresh Antony [c,*]

[a] *University of Texas Medical School at Houston, Houston, Texas, USA*
[b] *Private Practice, El Paso, Texas, USA*
[c] *Texas Tech University Health Sciences Center, 1205 N Oregon, El Paso, TX 79902, USA*

ARTICLE INFO

Article history:
Received 5 May 2009
Received in revised form 31 July 2009
Accepted 23 September 2009

Corresponding Editor: Vikas Trivedi, Meerut, India

Keywords:
Pasteurella multocida
Arthroplasty
Infections
Bacteremia

SUMMARY

Total knee arthroplasty (TKA) infection are most commonly due *Staphylococcus aureus* followed by coagulase-negative staphylococci, and streptococci, while gram-negative rods are seldom isolated.[1,3,4] In the last 20 years, cases of *Pasteurella multocida* TKA and total hip arthroplasty (THA) infection resulting from cat and dog bites, scratches, or licks have been published reporting varying presentations and treatment options. Most commonly, *P. multocida* infected arthroplasties result in local tenderness, cellulitis, and purulent discharge followed by regional adenopathy, and in immunocompromised patients it may progress to septicemia, meningitis, and septic arthritis.[5] Treatment antibiotics include penicilins or 2nd and 3rd generation cephalosporins, and surgical options involve one-stage, or two-stage revision arthroplasties.[6,9,17,19] We report a case of *P. multocida* TKA infection in a patient who was treated successfully with a 3rd generation cephalosporin, synovectomy and tibial interspacer exchange, along with a review of the literature published in the last 10 years. Our findings show that there is usually a history of exposure to the animal, early appearance of cat bite related infections, and multifactorial decision making for the treatment of *P. multocida* joint infections.

1. Introduction

Late total knee arthroplasty (TKA) infections of any type account for about 33% of infected TKAs, which occur in 1–2% of all cases of TKA.[1,2] Most commonly, infection is due *Staphylococcus aureus*, followed by coagulase-negative staphylococci and streptococci, while Gram-negative rods are seldom isolated.[1,3,4] In the last 20 years, cases of *Pasteurella multocida* TKA and total hip arthroplasty (THA) infections resulting from cat and dog bites, scratches, or licks have been published, reporting varying presentations and treatment options. We present a case of *P. multocida* TKA infection in a patient who was treated successfully with synovectomy, intravenous antibiotics, and tibial interspacer exchange. Included in this report is a review of the literature of septic arthroplasty infections caused by *P. multocida* over the last 10 years.

2. Case report

A 66-year-old Caucasian male presented with a painful swollen left lower extremity, 7 days after being scratched by his cat. Nine months previously he had had a left TKA operation, with no complications prior to his date of presentation. On the day of admission he reported fever and chills with serosanguinous drainage that was noted from two sites on the anterior distal tibia, with cellulitis to his mid tibia. The pain and edema was localized to the left leg and knee with limited range of motion of the knee joint. The patient had a past medical history of hypertension.

Under sterile technique, the knee joint was aspirated and approximately 1000 ml of purulent fluid was removed. The patient was then placed on ampicillin–sulbactam 3.0 g every 6 h. Cultures and Gram stain of the knee aspirate along with complete blood count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were ordered, and results were as follows: the synovial fluid aspirate leukocyte count was 141×10^9 cells/l and Gram stain initially reported Gram-negative bacilli. The serum leukocyte count was 15×10^9 cells/l, the ESR 80 mm/h, and CRP was 25.4 mg/dl. One day after admission the decision was made to treat with arthrotomy, synovectomy, and replacement of the tibial interspacer. Four days post-admission, cultures of the aspirate returned positive for *P. multocida* sensitive to ampicillin–sulbactam and ceftriaxone. He was treated with ceftriaxone for 28 days. Follow-up 6 months and 1 year later revealed no evidence of recurrence.

* Corresponding author. Tel.: +1 915 533 4900; fax: +1 915 533 4902.
E-mail address: Suresh.Antony@att.net (S. Antony).

1201-9712/$36.00 – see front matter
doi:10.1016/j.ijid.2009.09.007

Table 1
Summary of *Pasteurella multocida* infected total arthroplasty data reported in the literature.

Author [Ref.]	Year	Site	Duration of Illness	Presentation	Labs	Antibiotics (and duration)	Recurrences	Removal vs. I&D	Meds prior	Risk factors
Heym et al. [1]	2006	TKA	3 weeks prior, dog licked wound on toe	Fever, pain, warm L ankle, red/swollen ankle and knee	CRP 277mg/l, leukocytes 14.5×10^9/l; purulent puncture with 29.8×10^9 leukocytes/l	(1) Amoxicillin, doxycycline (90 days); (2) doxycycline, ciprofloxacin, amoxicillin (7 days); (3) ciprofloxacin, rifampin (63 days)	Yes: 100 days post d/c abx 1 and 2	Removal with reimplantation	1 g oxacillin TID 2 days prior to admission	Age: 72 years; prior THA
Mehta and Mackie [6]	2004	THA	1 month prior cat scratch to R ankle	Pain, restricted ROM R hip	Borderline increase WBC; radiograph showed aseptic loosening of implant, fluid around component (+) *P. multocida*	Benzyl penicillin (7 days), ciprofloxacin (56 days)	No	Removal with reimplantation	10 mg prednisone PO QD	Age: 84 years; RA
Mehta and Mackie [6]	2004	THA	Cat scratch to L ankle, unknown DOI	Pyrexia, cellulitis L leg, tender edematous LN, painful L hip ROM; readmitted 2 weeks post d/c abx with pyrexia, painful ROM again	WBC, ESR, CRP slightly elevated, pus around hip (+) *P. multocida*	Empiric: flucloxacillin, benzyl penicillin, metronidazole (14 days); then: flucloxacillin (14 days); after readmission IV benzyl penicillin (28 days), then ciprofloxacin (56 days)	No	Removal with reimplantation	Non-specific steroids and MTX 15 mg weekly	Age: 57 years; RA
Stiehl et al. [8]	2004	TKA	12th post-op day, no animal contact, previous horse injury	Fever 39.4 °C, effusion, 2 days later opened – serosanguinous foul smelling fluid	CRP 22 mg/dl, ESR 121 mm/h, leukocytes 7.5×10^9/l	Cefazolin, changed to ciprofloxacin and piperacillin/tazobactam (unknown duration)	No	I&D and removal with reimplantation 3 months later	None	Age: 63 years
Polzhofer et al. [17]	2004	TKA	Few days DOI, cat bite to ipsilateral lower leg	Pain, swelling, erythema	CRP 194 mg/l, ESR 56 mm/h (not measurable), leukocytes 16.9×10^9/l	Ampicillin/sulbactam (21 days), clindamycin (21 days)	No	Arthroscopic I&D with irrigation–suction drainage (6 days)	None	Age: 73 years
Maradona et al. [11]	1997	TKA	45 days after dog bite L calf	15-day Hx of pain in L knee with fever and inflammation	Leukocytes 16×10^9/l, PML 9×10^9/l, purulent fluid (+) *P. multocida*	Penicillin G (21 days) then ciprofloxacin (21 days)	No	I&D	None	Age: 73 years, NIDDM, bilateral OA
Antuna et al. [5]	1997	TKA	60 days after dog bite to L calf	Fever 38 °C, warm, erythematous, tender joint with regional LAD	ESR 45 mm/h, leukocytes 13×10^9/l, bone scintigraphy with gallium 67 (+) for L knee	Ciprofloxacin (70 days)	No	I&D and removal with reimplantation	None	Age: 73 years, RA
Present case	2008	TKA	7 days after cat scratch to L anterior tibia	Fever, chills, pain, cellulitis, serosanguinous drainage	CRP 25.4 mg/dl, ESR 80 mm/h, synovial leukocytes 140×10^9/l, purulent aspirate (+) *P. multocida*	Ampicillin/sulbactam (4 days), ceftriaxone (28 days)	No	I&D and removal of tibial insert	None	Age: 66 years

I&D, incision and drainage; TKA, total knee arthroplasty; THA, total hip arthroplasty; L, left; R, right; CRP, C-reactive protein; d/c abx, discontinue antibiotics; TID, three times daily; ROM, range of motion; WBC, white blood cell count; PO, per os; QD, four times daily; RA, rheumatoid arthritis; DOI, duration of illness; LN, lymph node; ESR, erythrocyte sedimentation rate; IV, intravenous; MTX, methotrexate; Hx, history; PML, polymorphonuclear leukocytes; NIDDM, non-insulin-dependent diabetes mellitus; OA, osteoarthritis; LAD, lymphadenopathy .

3. Discussion

P. multocida is a facultatively anaerobic, fermentative Gram-negative coccobacillus found in the oropharynx of healthy animals.[1,5–9] It is known to cause the following clinical pictures: focal soft-tissue infection, bacteremia with or without metastatic spread, and rarely, chronic pulmonary infection.[6,9,10] *P. multocida* infection most commonly localizes in the skin and soft tissues. Septic arthritis by this agent in normal or diseased joints accounts for 6% of all *P. multocida* infections.[11,12] Transmission can occur from animal to human post-injury by (1) hematogenous mechanism, and (2) local contamination.[8] According to Stiehl et al., the hematogenous mechanism is the most common method of dissemination of the infection between the two.[8] Risk factors for infection include age, diabetes, rheumatoid arthritis (RA), obesity, immunosuppression, number of previous surgical interventions, renal insufficiency, excessive intra-operative blood loss, hematoma, and days of post-operative drainage.[1,4,9,13,14] Sixteen cases of TKA and two of THA sepsis have been reported in the literature caused by a dog or cat bite, scratch, or lick.

It has been suggested that pain and swelling are the most sensitive, although not specific, symptoms associated with infected TKAs in general, and in combined studies, pain was present in nearly 100% of infected TKAs.[3] Most commonly, *P. multocida*-infected arthroplasties result in local tenderness, cellulitis, and purulent discharge, followed by regional adenopathy. In immunocompromised patients it may progress to septicemia, meningitis, and septic arthritis.[5] A common feature in our case and others in the last 10 years, was fever, in both non-immunocompromised and compromised hosts.

Many of the cases report supporting data such as ESR, CRP, and white blood cell count values as contributory to identification of the infection (Table 1). It is well known that many of these acute phase reactants are non-specific, yet they are used to endorse further investigation especially when confronting an infectious etiology. When recorded, 100% of ESR and/or CRP values were abnormal. The most accurate method of assessment for TKA infection, however, is knee aspiration with culture.

Multiple treatment options for this infection have been presented in the past and include synovectomy with removal of the prosthesis and delayed reimplantation. In addition, arthroscopic irrigation and use of multiple antibiotics in combination with the operative techniques are also suggested. The recommended intravenous antibiotic treatments that have been employed to treat *P. multocida* joint sepsis include penicillin or second- and third-generation cephalosporins. Oral antibiotic treatments are penicillin V, amoxicillin, amoxicillin–clavulanate, cefuroxime, tetracyclines, and fluoroquinolones.[6,9] Oral cephalosporins such as cephalexin and cefazolin are not effective as they do not achieve adequate blood levels.[9,15] Intravenous ceftriaxone was chosen primarily due to ease of dosing as an outpatient. According to Heym et al., antibiotic treatment alone without removal of an infected TKA is possible when (1) the infection is acute, (2) the responsible microorganism has been isolated, (3) the organism is susceptible to oral antibiotics, (4) antibiotics could be tolerated without serious toxicity, and (5) the prosthesis was not loose. If infectious signs are severe, the intervention of choice is debridement and synovectomy, which allows cleaning of the inflamed and infected peri-prosthetic tissues and increases the chances for retaining the prosthesis in spite of infection.[1,16,17]

Removal of the prosthesis is recommended in cases of septic implant loosening by one-stage or two-stage revision surgery with exchange of implants and use of antibiotic impregnated bone cement.[17–19] Polzhofer et al. suggest that the debridement and synovectomy can be performed arthroscopically in the event that there is no implant loosening.[17] Of the cases presented in the last 10 years, 62.5% had their prosthesis removed with reimplantation at a later time. In our case, there was no determined need for complete removal with replacement. We chose to remove the interspacer to allow thorough debridement of the joint space and replace it with a new plastic component. Factors that may have influenced our treatment when compared to the other cases were lack of co-morbidities such as RA and diabetes. Mehta and Mackie advocate that patients with prosthetic joints, particularly if immunocompromised, should be warned that cat and dog bites and cat scratches are potential sources of infection and that they should seek urgent medical attention.[6] Lastly, Maradona et al. advise that antibiotic prophylaxis would be prudent in patients who have suffered a pet bite and have a prosthetic joint or RA or have undergone corticosteroid therapy.[11] Interestingly, we observed through our analysis that cat bite-related infections present earlier than dog bite infections and may require early intervention (Table 1). This was defined as the time the patient reported their original inoculation injury to when they presented with the endoprosthetic infection. This was further supported by Takwale et al. who reported that they experienced rapid metastatic spread from the scratch to joint in-spite of antibiotics starting 24 h after the initial scratch.[15] Both Takwale and Mehta suggest that due to the rapidity of spread, prophylaxis should be started early.[6,15]

In conclusion, this case reiterates several important issues related to the diagnosis and treatment of Pasteurella-related joint infections: (1) there is usually a history of exposure to the animal, (2) cat bite-related infections tend to appear earlier and may be more severe, (3) the decision to perform an exchange arthroplasty is multifactorial and is based on the severity of infection, clinical presentation, and response to appropriate antimicrobial therapy.

Conflict of interest

No conflict of interest to declare.

References

1. Heym B, Jouve F, Lemoal M, Veil-Picard A, Lortat-Jacob A, Nicolas-Chanoine MH. *Pasteurella multocida* infection of a total knee arthroplasty after a "dog lick". *Knee Surg Sports Traumatol Arthrosc* 2006;**14**:993–7.
2. Peersman G, Laskin R, Davis J, Peterson M. Infection in total knee replacement. A retrospective review of 6489 total knee replacements. *Clin Orthop* 2001;**392**: 15–23.
3. Bach C, Sturmer R, Nogler M, Wimmer C, Biedermann R, Krismer M. Total knee arthroplasty infection significance of delayed aspiration. *J Arthroplasty* 2002;**17**:615–8.
4. Saleh K, Olson M, Resig S, Bershadsky B, Kuskowski M, Gioe T, et al. Predictors of wound infection in hip and knee joint replacement: results from a 20 year surveillance program. *J Orthop Res* 2002;**20**:506–15.
5. Antuna SA, Mendez JG, Castellanos JL, Jimenez JP. Late infection after total knee arthroplasty caused by *Pasteurella multocida*. *Acta Orthop Belg* 1997;**63**:310–2.
6. Mehta H, Mackie I. Prosthetic joint infection with *Pasteurella multocida* following a cat scratch: a report of 2 cases. *J Arthroplasty* 2004;**19**:525–7.
7. Murray P, Rosenthal K, Pfaller M. Medical microbiology, 5th ed., Philadelphia: Elsevier Mosby; 2005.
8. Stiehl J, Sterkin L, Brummitt C. Acute *Pasteurella multocida* in total knee arthroplasty. *J Arthroplasty* 2004;**19**:244–7.
9. Weber DJ, Hansen A. Infections resulting from animal bites. *Infect Dis Clin North Am* 1991;**5**:663–80.
10. Furie RA, Cohen RP, Hartman BJ, Roberts RB. *Pasteurella multocida* infection: report in an urban setting and review of spectrum of human disease. *N Y State J Med* 1980;**80**:1597.
11. Maradona JA, Asensi V, Carton JA, Rodriguez Guardado A, Lizon Castellano J. Prosthetic joint infection by *Pasteurella multocida*. *Eur J Clin Microbiol Infect Dis* 1997;**16**:623–5.
12. Weber DJ, Wolfson JS, Swartz MN, Hooper DC. *Pasteurella multocida* infections: report of 34 cases and review of the literature. *Medicine* 1984;**63**:133–54.
13. Berbari EF, Hanssen AD, Duffy MC, Steckelberg JM, Ilstrup DM, Harmsen WS, et al. Risk factors for prosthetic joint infections: case control study. *Clin Infect Dis* 1998;**27**:1247–54.
14. Furnes O, Espehaug B, Lie SA, Vollset SE, Engesaeter LB, Havelin LI. Early failures among 7,174 primary to tal knee replacements: a follow-up study from the Norwegian Arthroplasty Register 1994–2000. *Acta Orthop Scand* 2002;**73**:117–29.
15. Takwale VJ, Wright ED, Bates J, Edge AJ. *Pasteurella multocida* infection of total hip arthroplasty following cat scratch. *J Infect* 1997;**34**:263–4.

16. Lortat-Jacob A, Desplaces N, Gaudias J, Dacquet V, Dupon M, Carsenti H, et al., Tiresias Group. Infection secondaire de prothése articulare: critéres du diagnostic, traitement et prevention. *Rev Chir Orthop* 2002;**88**:51–61.
17. Polzhofer G, Hassenpflug J, Petersen W. Arthroscopic treatment of septic arthritis in a patient with posterior stabilized total knee arthroplasty. *J Arthroscop Rel Surg* 2004;**20**:311–3.
18. Bengston S, Knutson K, Lidgren L. Treatment of infected knee arthroplasty. *Clin Orthop* 1989;**245**:173–8.
19. Windsor RE, Insall JN, Urs WK, Miller DV, Brause BD. Two-stage reimplantation for the salvage of total knee arthroplasty complicated by infection. *J Bone Joint Surg Am* 1990;**72**:272–8.